Silvermine River

Watershed Summary

WATERSHED DESCRIPTION AND MAPS

The Silvermine River watershed covers an area of approximately 14,415 acres in the southwestern corner of Connecticut (Figure 1). The watershed is located in New Canaan, Ridgefield, Norwalk and Wilton, CT. The uppermost headwaters extend into southeastern New York and Ridgefield, CT, and the lower portion of the watershed extends into Norwalk, CT.

The Silvermine River watershed includes one segment impaired for recreation due to elevated bacteria levels (CT7302-00_02). This segment was assessed by Connecticut Department of Energy and Environmental Protection (CT DEEP) and included in the CT 2010 303(d) list of impaired waterbodies. Some segments in the watershed were currently unassessed as of the writing of this document. This does not suggest that there are no issues on these segments, but indicates a lack of current data to evaluate the segments as part of the assessment process. An excerpt of the Integrated Water Quality Report is included in Table 1 to show the status of waterbodies in the watershed (CT DEEP, 2010).

The East and West Branches of the Silvermine River begin in the Towns of Lewisboro, NY and Ridgefield, CT, flow southerly through New Canaan, Wilton, and Norwalk, merge at Browns Reservoir near Bald Hill and Kents Pond in Wilton, and ends at the confluence with the Norwalk River just south of Perry Avenue in Norwalk. The 5.49 mile-long bacteria impaired segment of the Silvermine River (CT7302-00_02) begins at the Grupes Reservoir outlet dam upstream of the Valley Road crossing in New Canaan, flows south through New Canaan, follows the Wilton-New Canaan border, enters Norwalk, and ends at the Merritt Parkway (Route 15 crossing) in Norwalk (Figure 2).

The impaired segment of Silvermine River has a water quality classification of A. Designated uses include potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. As there are no designated beaches in this segment of the Silvermine River, the specific recreation impairment is for non-designated swimming and other water contact related activities.

Impaired Segment Facts

Impaired Segment: Silvermine River (CT7302-00_02)

Municipalities: New Canaan, Wilton, and Norwalk

Impaired Segment Length (miles): 5.49

Water Quality Classification: Class A

Designated Use Impairment: Recreation

Sub-regional Basin Name and Code: Silvermine River, 7302

Regional Basin: Norwalk

Major Basin: Southwest Coastal

Watershed Area (acres): 14,415

MS4 Applicable? Yes

Applicable Season: Recreation Season (May 1 to September 30)

Figure 1: Watershed location in Connecticut

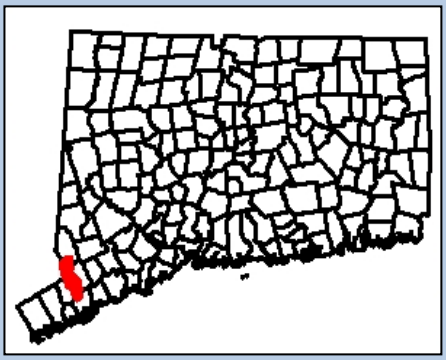
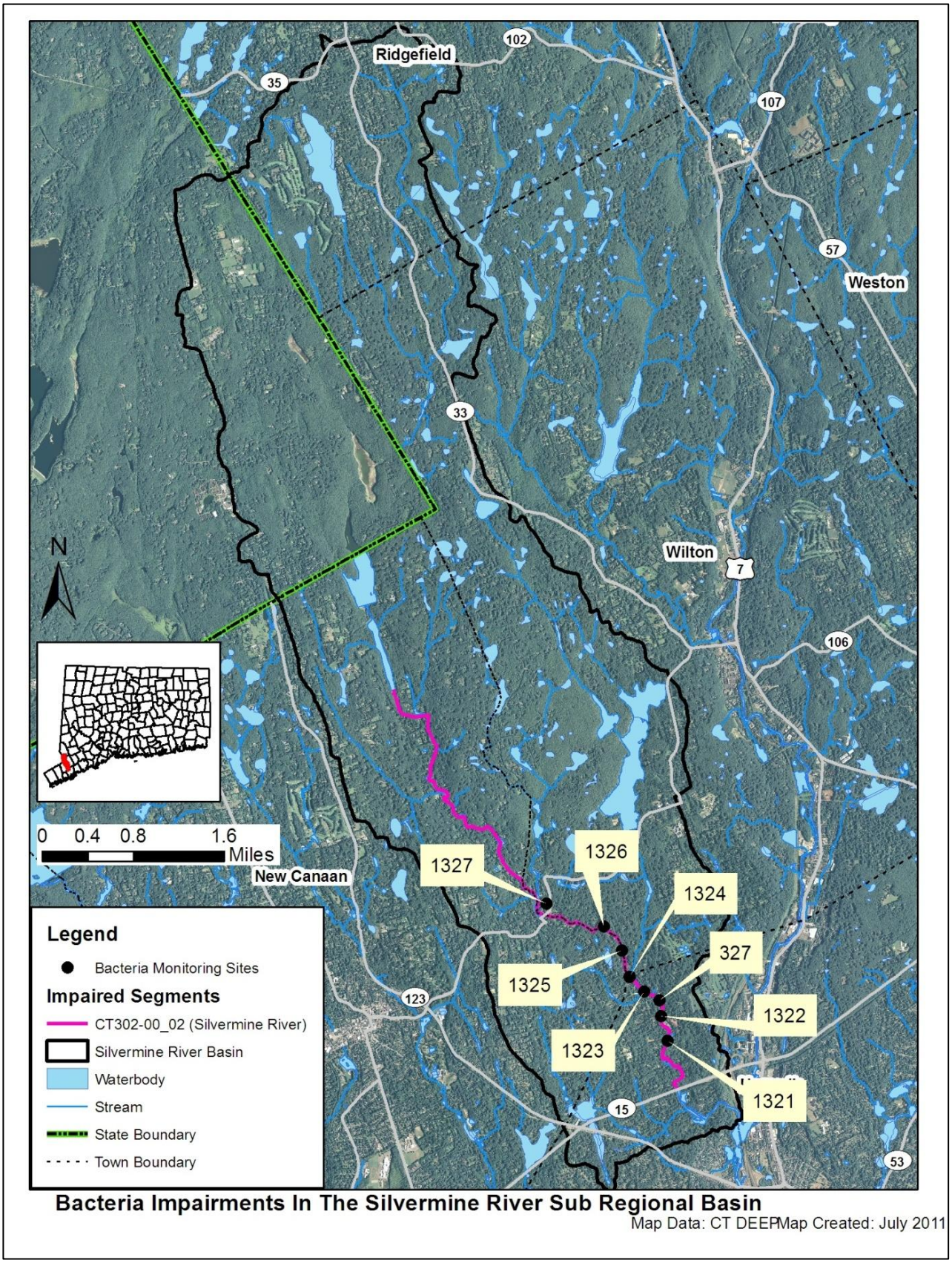


Table 1: Impaired segment and nearby waterbodies from the Connecticut 2010 Integrated Water Quality Report

Waterbody ID	Waterbody Name	Location	Miles	Aquatic Life	Recreation	Fish Consumption
CT7302-00_01	Silvermine River-01	From mouth at confluence with Norwalk River (northwest inlet to Deering Pond portion of river), US to Merritt Parkway (Route 15 crossing), Norwalk. (Segment includes Davis Pond)	0.98	U	NOT	FULL
CT7302-00_02	Silvermine River-02	From Merritt Parkway (Route 15) crossing, Norwalk, US to Grupes Reservoir outlet dam (US of Valley Road crossing), New Canaan.	5.49	U	NOT	FULL
Shaded cells indicate impaired segment addressed in this TMDL **FULL = Designated Use Fully Supported** **NOT = Designated Use Not Supported** **U = Unassessed**						

CT7302-00_01 of the Silvermine River was not included in this TMDL, but is discussed in more detail in the 2005 CT DEEP TMDL for the Norwalk River Regional Basin at: http://www.ct.gov/dep/lib/dep/water/tmdl/tmdl_final/norwalktmdlfinal.pdf.

Figure 2: GIS map featuring general information of the Silvermine River watershed at the sub-regional level



Land Use

Existing land use can affect the water quality of waterbodies within a watershed (USEPA, 2011c). Natural processes, such as soil infiltration of stormwater and plant uptake of water and nutrients, can occur in undeveloped portions of the watershed. As impervious surfaces (such as rooftops, roads, and sidewalks) increase within the watershed landscape from commercial, residential, and industrial development, the amount of stormwater runoff to waterbodies also increases. These waterbodies are negatively affected as increased pollutants from nutrients and bacteria from leaking septic systems, oil and grease from automobiles, and sediment from construction activities become entrained in this runoff. Agricultural land use activities, such as fertilizer application and manure from livestock, can also increase pollutants in nearby waterbodies (USEPA, 2011c).

As shown in Figures 3 and 4, the Silvermine River watershed consists of 52% forest, 41% urban, 6% water, and 1% agriculture land uses. The portion of the watershed in New Canaan, Wilton and Norwalk, particularly near the impaired segment of the Silvermine River is characterized by suburban residential development with forested open spaces such as Wild Duck Road and Comstock Hill. The suburban residential land use becomes more dense as the Silvermine River passes east of New Canaan and before the river crosses the Merritt Parkway (Route 15). There are also more commercial areas near the southern portion of the impaired segment of the Silvermine River in Norwalk where Silvermine Elementary School, Silvermine Arts Center, bed and breakfasts, and various shops are located. The upper watershed north of the impaired segment is heavily forested, particularly in Lewisboro, NY where several drinking water reservoirs can be found. The uppermost reaches of the eastern branch of the Silvermine River are more developed around the Town of Ridgefield, but flow downstream through several forested tracts such as Vista Road Open Space, Quarry Head Park, and Kellogg Drive Open Space.

Figure 3: Land use within the Silvermine River watershed

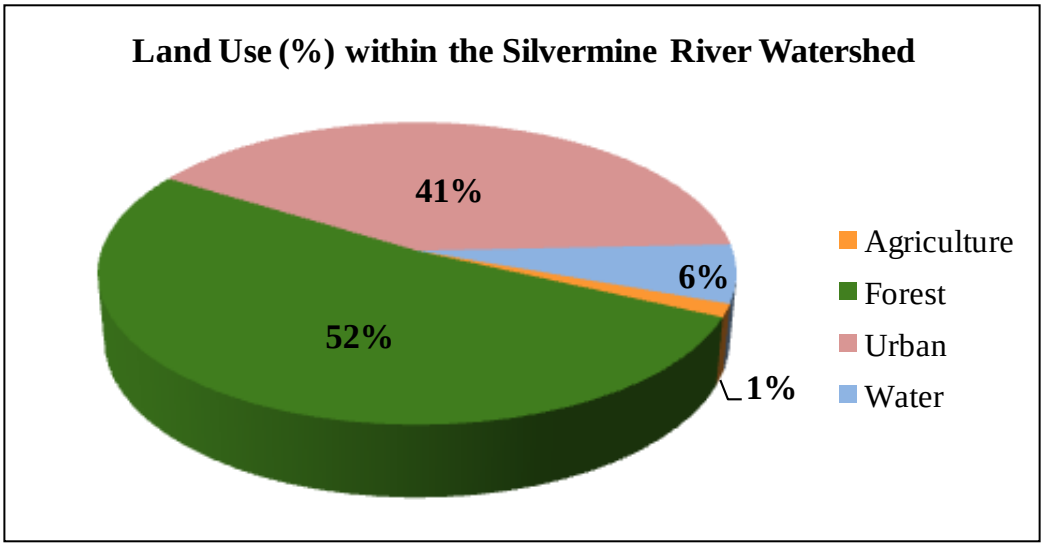
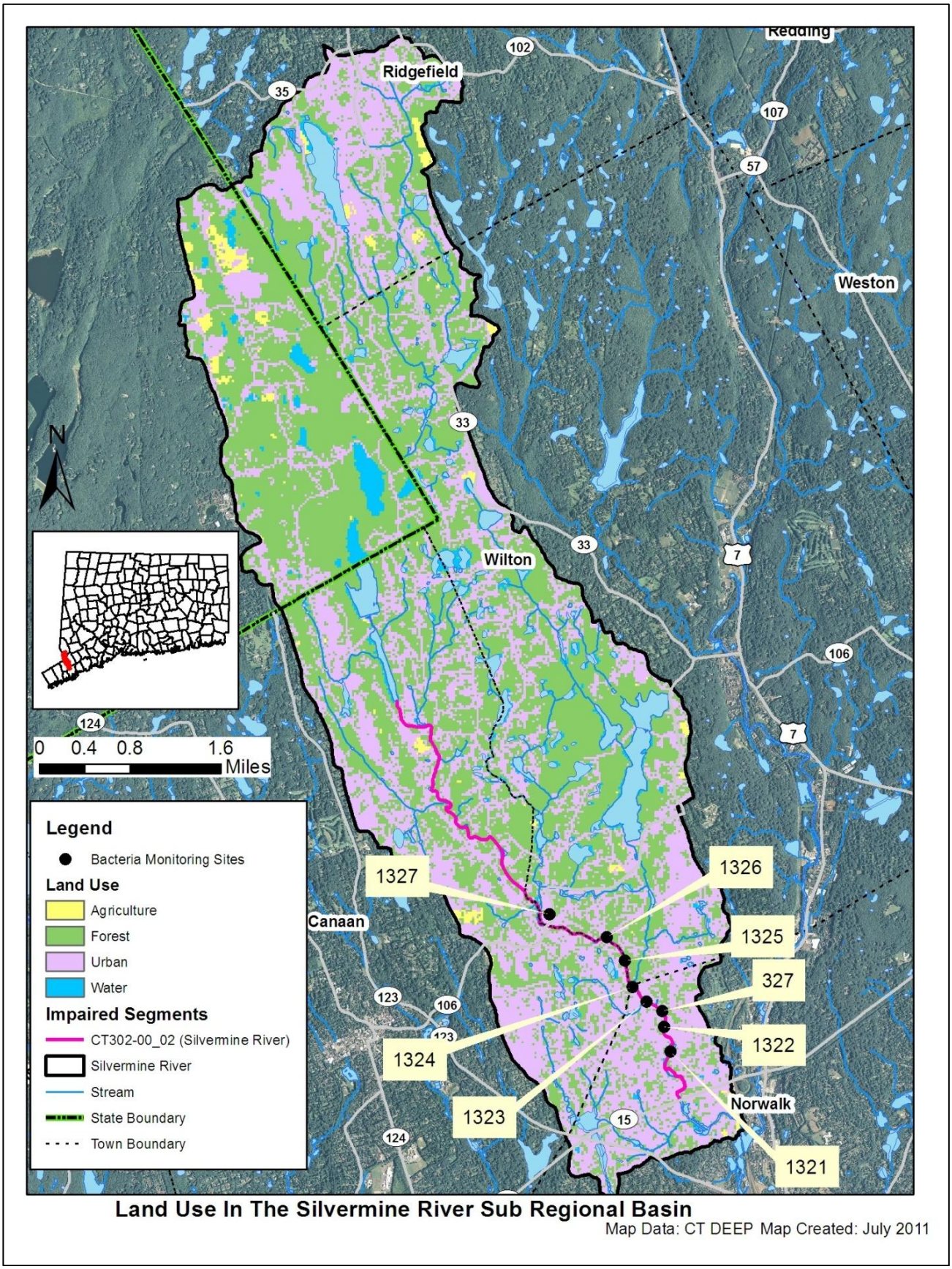


Figure 4: GIS map featuring land use for the Silvermine River watershed at the sub-regional level



WHY IS A TMDL NEEDED?

E. coli is the indicator bacteria used for comparison with the CT State criteria in the CT Water Quality Standards (WQS) (CTDEEP, 2011). All data results are from CT DEEP, USGS, Bureau of Aquaculture, or volunteer monitoring efforts at stations located on the impaired segments.

Table 2: Sampling station location description for the impaired segment in the Silvermine River watershed (stations organized downstream to upstream)

Waterbody ID	Waterbody Name	Station	Station Description	Municipality	Latitude	Longitude
CT7302-00_02	Silvermine River	1321	Silvermine Elementary School	Norwalk	41.145183	-73.441872
CT7302-00_02	Silvermine River	1322	Silvermine Elementary School	Norwalk	41.148319	-73.442997
CT7302-00_02	Silvermine River	327	Alvin Road downstream of Perry Avenue	Norwalk	41.150322	-73.443356
CT7302-00_02	Silvermine River	1323	Perry Avenue	Norwalk	41.151472	-73.445969
CT7302-00_02	Silvermine River	1324	Small farm at confluence with Belden Hill Brook	Wilton	41.153331	-73.448425
CT7302-00_02	Silvermine River	1325	NNT confluence	Wilton	41.156686	-73.449761
CT7302-00_02	Silvermine River	1326	Borglum Road	Wilton	41.159714	-73.452858
CT7302-00_02	Silvermine River	1327	New Canaan Road	Wilton	41.162569	-73.462569

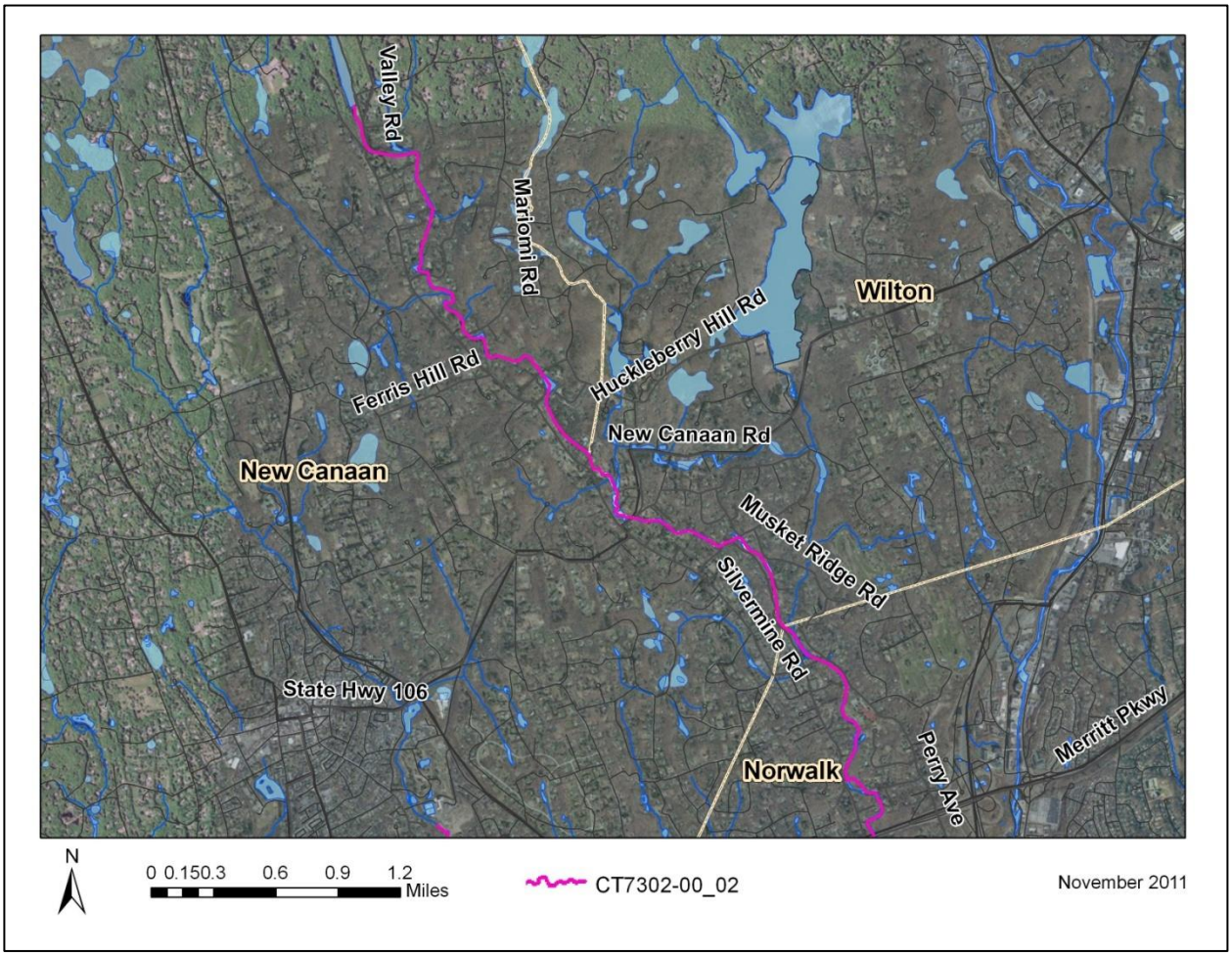
The Silvermine River (CT7302-00_02) is a Class A freshwater river (Figure 5). Its applicable designated uses are potential drinking water supplies, habitat for fish and other aquatic life and wildlife, recreation, navigation, and industrial and agricultural water supply. Water quality analyses were conducted using data from eight sampling locations on the Silvermine River: Stations 327, 1321, 1322, 1323, 1324, 1325, 1326, and 1327 (Table 2).

For the impaired segment of the Silvermine River, the water quality criteria for *E. coli*, along with bacteria sampling results for Station 327 in 1998, and Stations 1321, 1322, 1323, 1324, 1325, 1326, and 1327 in 2003 are presented in Table 11. The annual geometric mean was calculated for all stations and exceeded the WQS for *E. coli* at Station 327 in 1998 and at Stations 1321, 1322, and 1323 in 2003. Single sample values at these stations also exceeded the WQS for *E. coli* multiple times. For Stations 1324, 1325, 1326, and 1327, the calculated annual geometric mean did not exceed the WQS for *E. coli.* Stations 1325, 1326, and 1327 exceeded single sample values multiples times in 2003, and Station 1324 exceeded single sample values only once in 2003 during wet weather conditions.

To aid in identifying possible bacteria sources, the geometric mean was also calculated for each station for wet-weather and dry-weather sampling days, where appropriate (Table 11). For the impaired segment of the Silvermine River, geometric mean values at Stations 1327, 1321, and 1323 exceeded the WQS for *E. coli* during both wet and dry-weather. Geometric mean values exceeded the WQS for *E. coli* during wet-weather at Stations 1322, 1325, 1326, and 1327.

Due to the elevated bacteria measurements presented in Table 11, this segment of the Silvermine River did not meet CT's bacteria WQS, was identified as impaired, and was placed on the CT List of Waterbodies Not Meeting Water Quality Standards, also known as the CT 303(d) Impaired Waters List. The Clean Water Act requires that all 303(d) listed waters undergo a TMDL assessment that describes the impairments and identifies the measures needed to restore water quality. The goal is for all waterbodies to comply with State WQS.

Figure 5: Aerial map of the Silvermine River



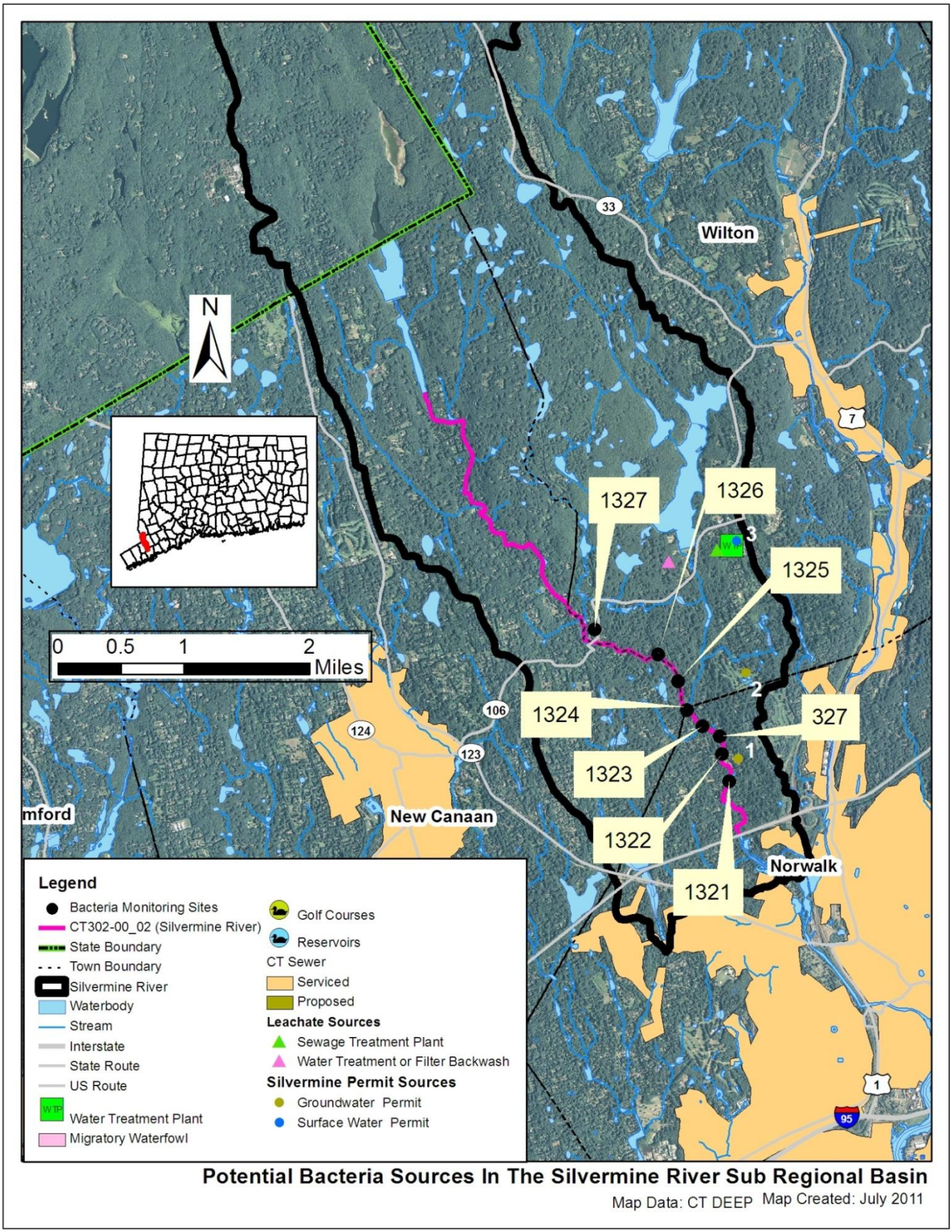
POTENTIAL BACTERIA SOURCES

Potential sources of indicator bacteria in a watershed include point and non-point sources, such as stormwater runoff, agriculture, sanitary sewer overflows (collection system failures), illicit discharges, and inappropriate discharges to the waterbody. Potential sources that have been tentatively identified in the watershed based on land use (Figures 3 and 4) and a collection of local information for the impaired waterbody is presented in Table 3 and Figure 6. However, the list of potential sources is general in nature and should not be considered comprehensive. There may be other sources not listed here that contribute to the observed water quality impairment in the study segments. Further monitoring and investigation will confirm listed sources and discover additional ones. Some segments in this watershed are currently listed as unassessed by CT DEEP procedures. This does not suggest that there are no potential issues on this segment, but indicates a lack of current data to evaluate the segment as part of the assessment process. For some segments, there are data from permitted sources, and CT DEEP recommends that any elevated concentrations found from those permitted sources be addressed through voluntary reduction measures. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement these TMDLs.

Table 3: Potential bacteria sources in the Silvermine River watershed

Impaired Segment	Permit Source	Illicit Discharge	CSO/SSO Issue	Failing Septic System	Agricultural Activity	Stormwater Runoff	Nuisance Wildlife/Pets	Other
Silvermine River CT7302-00_02	x	x		x	x	x	x	

Figure 6: Potential sources in the Silvermine River watershed at the sub-regional level



The potential sources map for the impaired basin was developed after thorough analysis of available data sets. If information is not displayed in the map, then no sources were discovered during the analysis. The following is the list of potential sources that were evaluated: problems with migratory waterfowl, golf course locations, reservoirs, proposed and existing sewer service, cattle farms, poultry farms, permitted sources of bacteria loading (surface water discharge, MS4 permit, industrial stormwater, commercial stormwater, groundwater permits, and construction related stormwater), and leachate and discharge sources (agricultural waste, CSOs, failing septic systems, landfills, large septic tank leach fields, septage lagoons, sewage treatment plants, and water treatment or filter backwash).

Point Sources

Permitted sources within the watershed that could potentially contribute to the bacteria loading are identified in Table 4. This table includes permit types that may or may not be present in the impaired watershed. A list of active permits in the watershed is included in Table 5. Additional investigation and monitoring may reveal the presence of additional discharges in the watershed. Available effluent data from each of these permitted categories found within the watershed are compared to the CT State WQS for the appropriate receiving waterbody use and type (Table 6).

Table 4: General categories list of other permitted discharges

Permit Code	Permit Description Type	Number in watershed
CT	Surface Water Discharges	0
GPL	Discharge of Swimming Pool Wastewater	0
GSC	Stormwater Discharge Associated with Commercial Activity	0
GSI	Stormwater Associated with Industrial Activity	0
GSM	Part B Municipal Stormwater MS4	3
GSN	Stormwater Registration – Construction	0
LF	Groundwater Permit (Landfill)	0
UI	Underground Injection	2

Permitted Sources

As shown in Table 5, there are multiple permitted discharges in the Silvermine River watershed. Since the MS4 permits are not targeted to a specific location, but the geographic area of the regulated municipality, there is no one accurate location on the map to display the location of these permits. One dot will be displayed at the geographic center of the municipality as a reference point. Sometimes this location falls outside of the targeted watershed and therefore the MS4 permit will not be displayed in the Potential Sources Map. Using the municipal border as a guideline will show which areas of an affected watershed are covered by an MS4 permit.

Table 5: Permitted facilities within the Silvermine River watershed

Town	Client	Permit ID	Permit Type	Site Name/Address	Map #
New Canaan	Town of New Canaan	GSM000079	Part B Municipal Stormwater MS4	New Canaan, Town of	N/A
Norwalk	City Of Norwalk	UI0000301	Groundwater Permit	Silvermine Elementary School	1
Norwalk	City Of Norwalk	GSM000024	Part B Municipal Stormwater MS4	Norwalk, City of	N/A
Wilton	Silvermine Woods Homeowner Association Inc.	UI0000065	Groundwater Permit	Silvermine Woods Homeowners Assoc	2
WILTON	SCHOOL SISTERS OF NOTRE DAME (Permittee)	CT0101419	Surface Water Permit Industrial NPDES Permits	SCHOOL SISTERS OF NOTRE DAME	3
Wilton	Town of Wilton	GSM000040	Part B Municipal Stormwater MS4	Wilton, Town of	N/A

Municipal Stormwater Permitted Sources

Per the EPA Phase II Stormwater rule all municipal storm sewer systems (MS4s) operators located within US Census Bureau Urbanized Areas (UAs) must be covered under MS4 permits regulated by the appropriate State agency. There is an EPA waiver process that municipalities can apply for to not participate in the MS4 program. In Connecticut, EPA has granted such waivers to 19 municipalities. All participating municipalities within UAs in Connecticut are currently regulated under MS4 permits by CT DEEP staff in the MS4 program.

The US Census Bureau defines a UA as a densely settled area that has a census population of at least 50,000. A UA generally consists of a geographic core of block groups or blocks that exceeds the 50,000 people threshold and has a population density of at least 1,000 people per square mile. The UA will also include adjacent block groups and blocks with at least 500 people per square mile. A UA consists of all or part of one or more incorporated places and/or census designated places, and may include additional territory outside of any place. (67 FR 11663)

For the 2000 Census a new geographic entity was created to supplement the UA blocks of land. This created a block known as an Urban Cluster (UC) and is slightly different than the UA. The definition of a UC is a densely settled area that has a census population of 2,500 to 49,999. A UC generally consists of a geographic core of block groups or blocks that have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile. A UC consists of all or part of one or more incorporated places and/or census designated places; such a place(s) together with adjacent territory; or territory outside of any place. The major difference is the total population cap of 49,999 people for a UC compared to >50,000 people for a UA. (67 FR 11663)

While it is possible that CT DEEP will be expanding the reach of the MS4 program to include UC municipalities in the near future they are not currently under the permit. However, the GIS layers used to create the MS4 maps in this Statewide TMDL did include both UA and UC blocks. This factor creates some municipalities that appear to be within an MS4 program that are not currently regulated through an MS4 permit. This oversight can explain a municipality that is at least partially shaded grey in the maps

and there are no active MS4 reporting materials or information included in the appropriate appendix. While these areas are not technically in the MS4 permit program, they are still considered urban by the cluster definition above and are likely to contribute similar stormwater discharges to affected waterbodies covered in this TMDL.

As previously noted, EPA can grant a waiver to a municipality to preclude their inclusion in the MS4 permit program. One reason a waiver could be granted is a municipality with a total population less than 1000 people, even if the municipality was located in a UA. There are 19 municipalities in Connecticut that have received waivers, this list is: Andover, Bozrah, Canterbury, Coventry, East Hampton, Franklin, Haddam, Killingworth, Litchfield, Lyme, New Hartford, Plainfield, Preston, Salem, Sherman, Sprague, Stafford, Washington, and Woodstock. There will be no MS4 reporting documents from these towns even if they are displayed in an MS4 area in the maps of this document.

The list of US Census UCs is defined by geographic regions and is named for those regions, not necessarily by following municipal borders. In Connecticut the list of UCs includes blocks in the following Census Bureau regions: Colchester, Danielson, Lake Pocotopaug, Plainfield, Stafford, Storrs, Torrington, Willimantic, Winsted, and the border area with Westerly, RI (67 FR 11663). Any MS4 maps showing these municipalities may show grey areas that are not currently regulated by the CT DEEP MS4 permit program.

The impaired segments of the Silvermine River watershed are located within the Towns of New Canaan and Wilton and the City of Norwalk, CT. The municipalities are largely urbanized, as defined by the U.S. Census Bureau, and are required to comply with the General Permit for the Discharge of Stormwater from Small Municipal Storm Sewer Systems (MS4 permit) issued by the Connecticut Department of Energy and Environmental Protection (DEEP) (Figure 7). This general permit is only applicable to municipalities that are identified in Appendix A of the MS4 permit that contain designated urban areas and discharge stormwater via a separate storm sewer system to surface waters of the State. The permit requires municipalities to develop a Stormwater Management Plan (SMP) to reduce the discharge of pollutants and protect water quality. The MS4 permit is discussed further in the "TMDL Implementation Guidance" section of the core TMDL document. Additional information regarding stormwater management and the MS4 permit can be obtained on CTDEEP's website (http://www.ct.gov/dep/cwp/view.asp?a=2721&q=325702&depNav_GID=1654).

Multiple MS4 outfalls have been sampled for *E. coli* bacteria in the watershed (Table 6). In New Canaan, four MS4 outfalls were sampled from 2007 – 2010. Of these outfalls, three exceeded the single sample water quality standard of 410 colonies/100 mL on at least one sample date.

Table 6: List of MS4 sample locations and *E. coli* (colonies/100 mL) results in the Silvermine River watershed

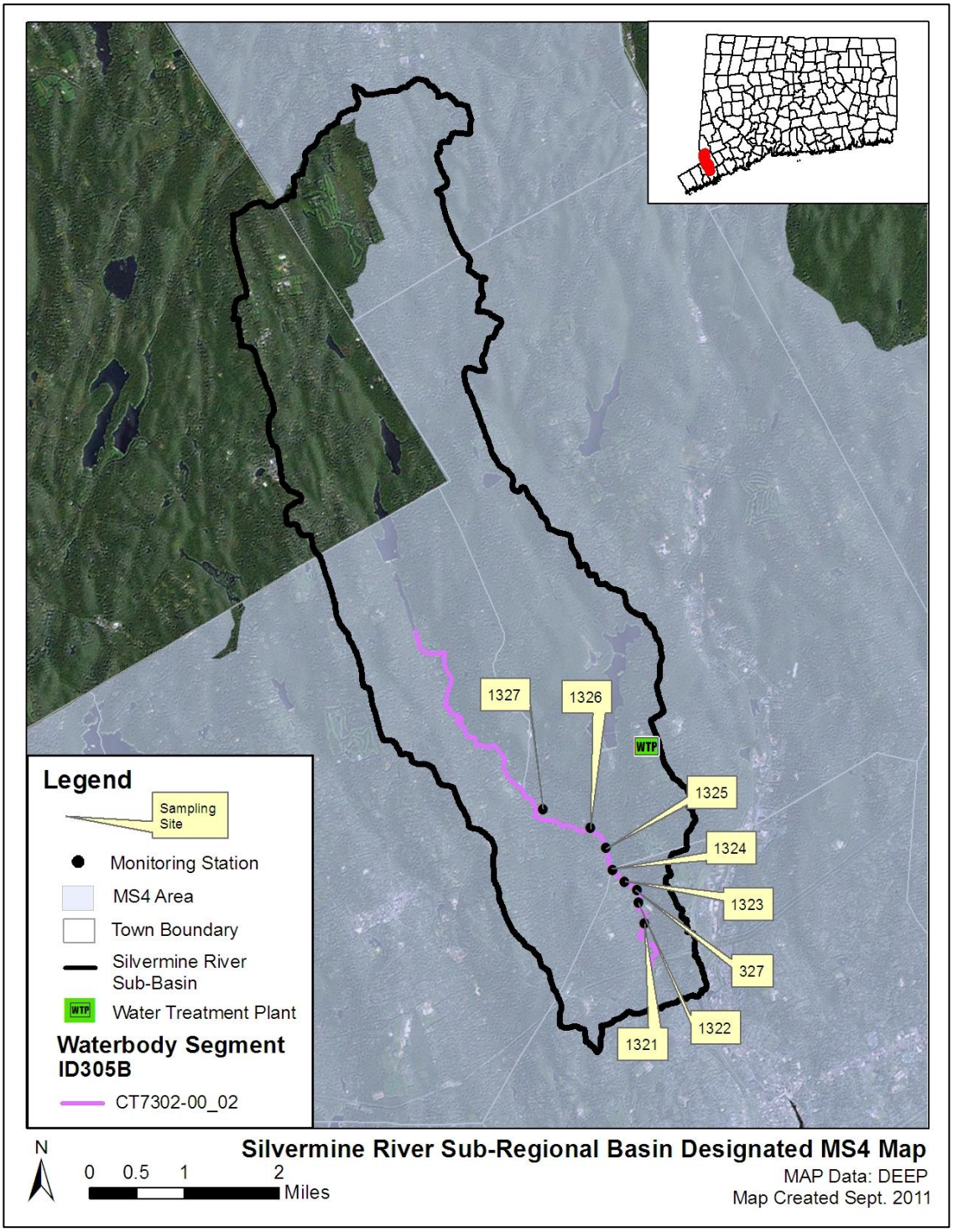
Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
New Canaan	SW-3 Mariomi Road	Residential	Silvermine River	09/11/09	30
New Canaan	SW-3 Mariomi Road	Residential	Silvermine River	09/27/10	650
New Canaan	SW-4 Hickock Road	Residential	Silvermine River	10/24/07	520
New Canaan	SW-4 Hickock Road	Residential	Silvermine River	09/26/08	670
New Canaan	SW-4 Hickock Road	Residential	Silvermine River	09/11/09	400
New Canaan	SW-4 Hickock Road	Residential	Silvermine River	09/27/10	3,600
New Canaan	SW-5 Hickock Road	Residential	Silvermine River	10/24/07	3,500

Town	Location	MS4 Type	Receiving Waters	Sample Date	Result
New Canaan	SW-5 Hickock Road	Residential	Silvermine River	09/26/08	240
New Canaan	SW-6 Benedict Hill/South Bald Hill	Residential	Silvermine River	10/24/07	120
New Canaan	SW-6 Benedict Hill/South Bald Hill	Residential	Silvermine River	09/26/08	350
Shaded cells indicate an exceedance of single-sample based water quality criteria (410 colonies/100 mL)					

Publicly Owned Treatment Works

As shown in Figure 7, there is one publicly owned treatment work (POTW), or wastewater treatment plant, in the Silvermine River watershed near the East Branch of the Silvermine River. This branch converges with the impaired West Branch of the Silvermine River downstream of the POTW. There are currently no data available for this facility.

Figure 7: MS4 areas of the Silvermine River watershed



Non-point Sources

Non-point source pollution (NPS) comes from many diffuse sources and is more difficult to identify and control. NPS pollution is often associated with land-use practices. Examples of NPS that can contribute bacteria to surface waters include insufficient septic systems, pet and wildlife waste, agriculture, and

contact recreation (swimming or wading). Potential sources of NPS within the Silvermine River watershed are described below. The 2004 Norwalk River Watershed Action Plan and the 2011 Norwalk River Watershed Based Plan describe many of these sources in greater detail (http://www.ct.gov/dep/lib/dep/water/watershed_management/wm_plans/norwalk_rwi_supp.pdf; and http://www.swrpa.org/Uploads/Norwalk_finalWBP_8-2011_take2_reduced.pdf).

Stormwater Runoff from Developed Areas

Approximately 41% of the land use in the Silvermine River watershed is considered urban, and the lower half of the impaired segment of the Silvermine River is located within the more populated lower portion of the watershed (Figures 4 and 9). Urban areas are often characterized by impervious cover, or surface areas such as roofs and roads that force water to run off land surfaces rather than infiltrate into the soil. Studies have shown a link between increasing impervious cover and degrading water quality conditions in a watershed (CWP, 2003). In one study, researchers correlated the amount of fecal coliform to the percent of impervious cover in a watershed (Mallin *et al.*, 2000).

As shown in Figure 8, approximately 14% of the Silvermine River watershed contains more than 16% impervious cover, particularly in the area around the lower half of the impaired segment (Figure 9). It should be noted that the percent impervious cover only includes the CT portion of the Silvermine River watershed. The excluded NY portion would include greater forested areas with only 0-6% impervious cover (Figure 9). Water quality data taken at all stations along the Silvermine River exceeded geometric mean standards during wet-weather, which suggests that stormwater runoff may be a source of bacteria to the impaired segment of the Silvermine River (Table 11). Stormwater pollution sources include fertilizer runoff, failing and insufficient septic systems, horse farms, golf courses, and impervious surfaces. The Norwalk River Watershed Based Plan (2011) identified urban runoff and storm sewers as potential sources of bacterial contamination to the Silvermine River.

Figure 8: Range of impervious cover (%) in the Silvermine River watershed

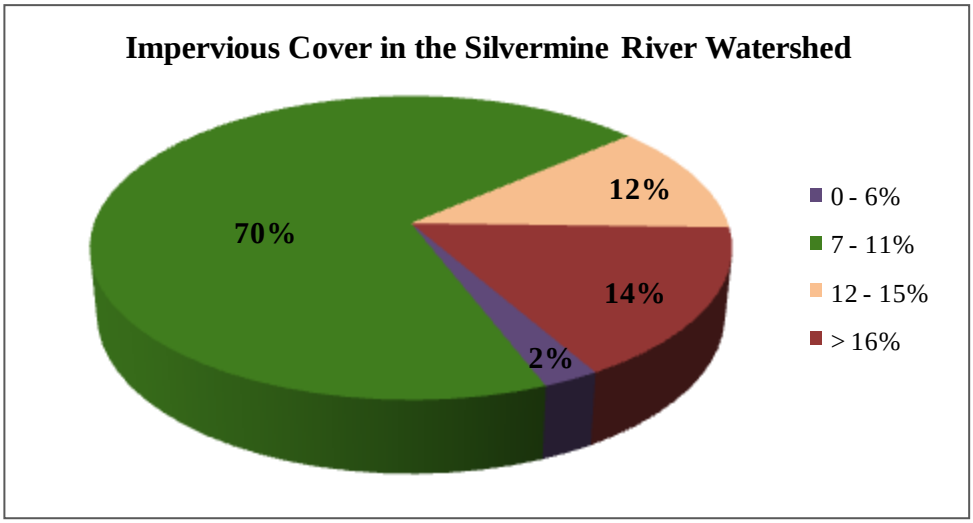
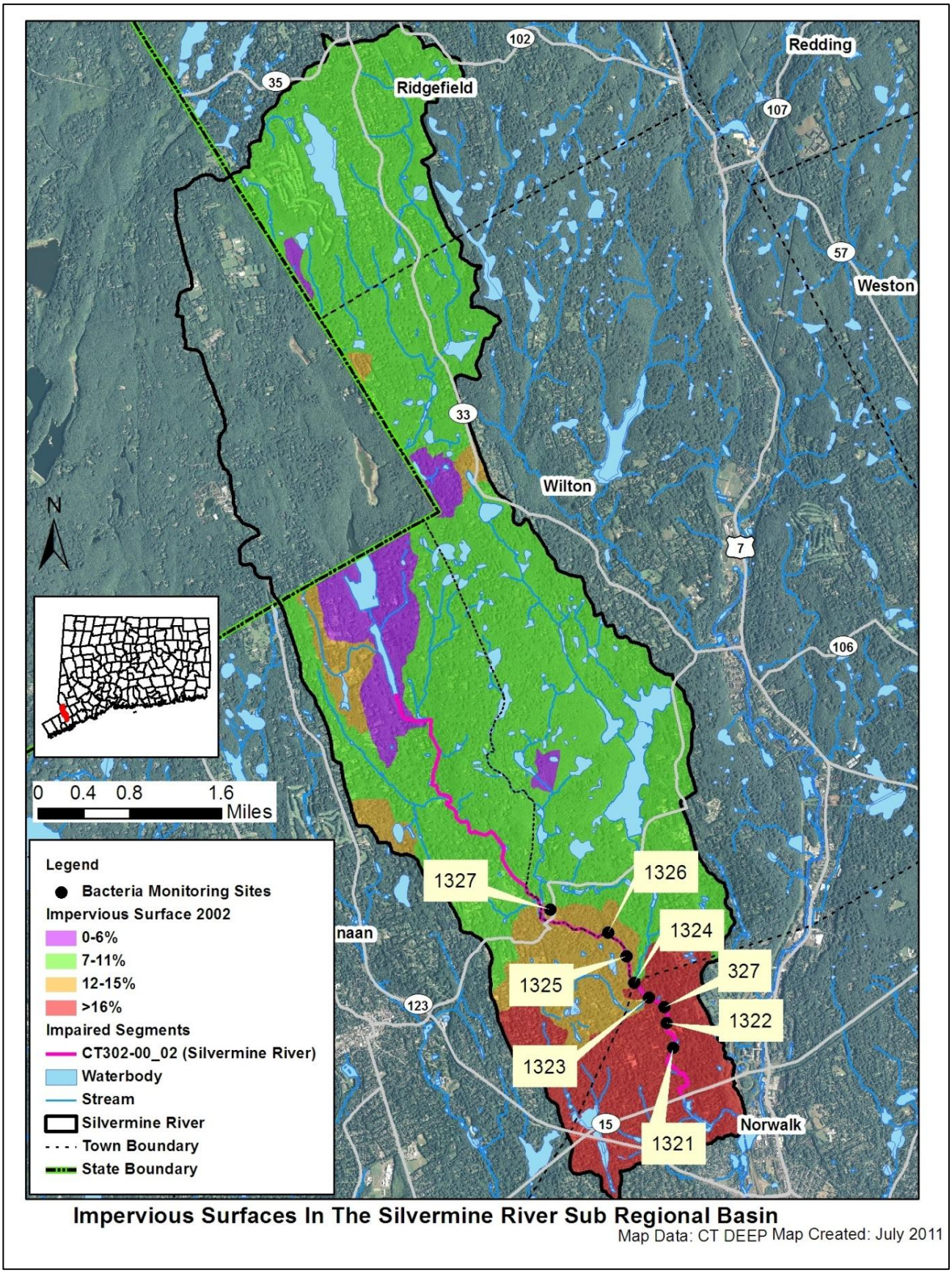


Figure 9: Impervious cover (%) for the Silvermine River sub-regional watershed



Insufficient Septic Systems and Illicit Discharges

As shown in Figure 6, only a small portion in the southern end of the watershed in Norwalk downstream of the impaired segment of the Silvermine River relies on the municipal sewer system. The majority of the watershed in New Canaan, Wilton, and Norwalk rely on onsite wastewater treatment systems, such as septic systems. Insufficient or failing septic systems can be significant sources of bacteria by allowing raw waste to reach surface waters. The Norwalk River Watershed Based Plan (2011) identified a failing septic system along the upper half of the impaired segment of the Silvermine River. As shown in Figure 6, there are also two potential leachate sources: a water treatment or filter backwash facility and sewage treatment plant upstream of the impaired segment along the East Branch of the Silvermine River.

In Connecticut, local health directors or health districts are responsible for keeping track of any reported insufficient or failing septic systems in a specific municipality. The Town of New Canaan has a full-time health director (http://www.newcanaan.info/content/293/307/default.aspx), the Town of Wilton has a full-time health director (http://www.wiltonct.org/departments/health.html), and the City of Norwalk also has a full-time health director (http://norwalkhealthdept.org/).

Sewer system leaks and other illicit discharges or connections can contribute bacteria to nearby surface waters. The Norwalk River Watershed Based Plan (2011) identified several illicit discharges to storm sewers downstream near the more urbanized portion of the impaired segment in Norwalk. The plan also identified hotspots for dry weather discharges with potential sanitary flows including James Street (Norwalk), Moody's Lane (Norwalk), and pond outlet at Department of Development Services (Norwalk). Although these discharges are not contributing bacteria to the impaired segment, they may be contributing to existing downstream impairments.

Wildlife and Domestic Animal Waste

Wildlife and domestic animals within the Silvermine River watershed represent another potential source of bacteria. With the construction of roads and drainage systems, these wastes may no longer be retained on the landscape, but instead may be conveyed via stormwater to the nearest surface water. These physical land alterations can exacerbate the impact of natural sources on water quality (USEPA, 2001). The majority of the watershed located in New Canaan and Wilton is undeveloped, thus wildlife waste may be a potential source of bacteria to the Silvermine River along the upper half of the impaired segment. The Norwalk River Watershed Based Plan (2011) identified wildlife and waterfowl as significant sources of bacteria to the Silvermine River. As the majority of the lower half of the impaired segment of the Silvermine River is located near residential development, pet waste may be a more direct potential source of bacteria.

The Silvermine Golf Club is located within the watershed along the Silvermine River. Geese and other waterfowl are known to congregate in open areas, including recreational fields, agricultural cropfields, and golf courses. In addition to creating a nuisance, large numbers of geese can also create unsanitary conditions on the grassed areas and cause water quality problems due to bacterial contamination associated with their droppings. Large populations of geese can also lead to habitat destruction as a result of overgrazing on wetland and riparian plants.

Agricultural Activities

Agricultural operations are an important economic activity and landscape feature in many areas of the State. Runoff from agricultural fields may contain pollutants such as bacteria and nutrients (USEPA, 2011a). This runoff can include pollutants from farm practices such as storing manure, allowing livestock

to wade in nearby waterbodies, applying fertilizer, and reducing the width of vegetated buffer along the shoreline. Although agricultural land use makes up only 1% of the Silvermine River watershed, there are two livestock farms along the Silvermine River that were addressed in the Norwalk River Watershed Based Plan (2011) as potential sources of bacterial contamination. High fecal counts were found north of the Silvermine Tavern in Wilton where domestic animals and waterfowl have access to the river via a small farm. Another small hobby farm at the confluence of the Silvermine River and Belden Hill Brook yielded high bacteria exceedances (see Station 1324).

Additional Sources

Two groundwater permits may be contributing to dry weather discharge exceedances seen at several stations along the impaired segment of the Silvermine River (Figure 6). There may be other sources not listed here or identified in Figure 6 that contribute to the observed water quality impairment in the Silvermine River. Further monitoring and investigation will confirm the listed sources and discover additional ones. More detailed evaluation of potential sources is expected to become available as activities are conducted to implement this TMDL.

Land Use/Landscape

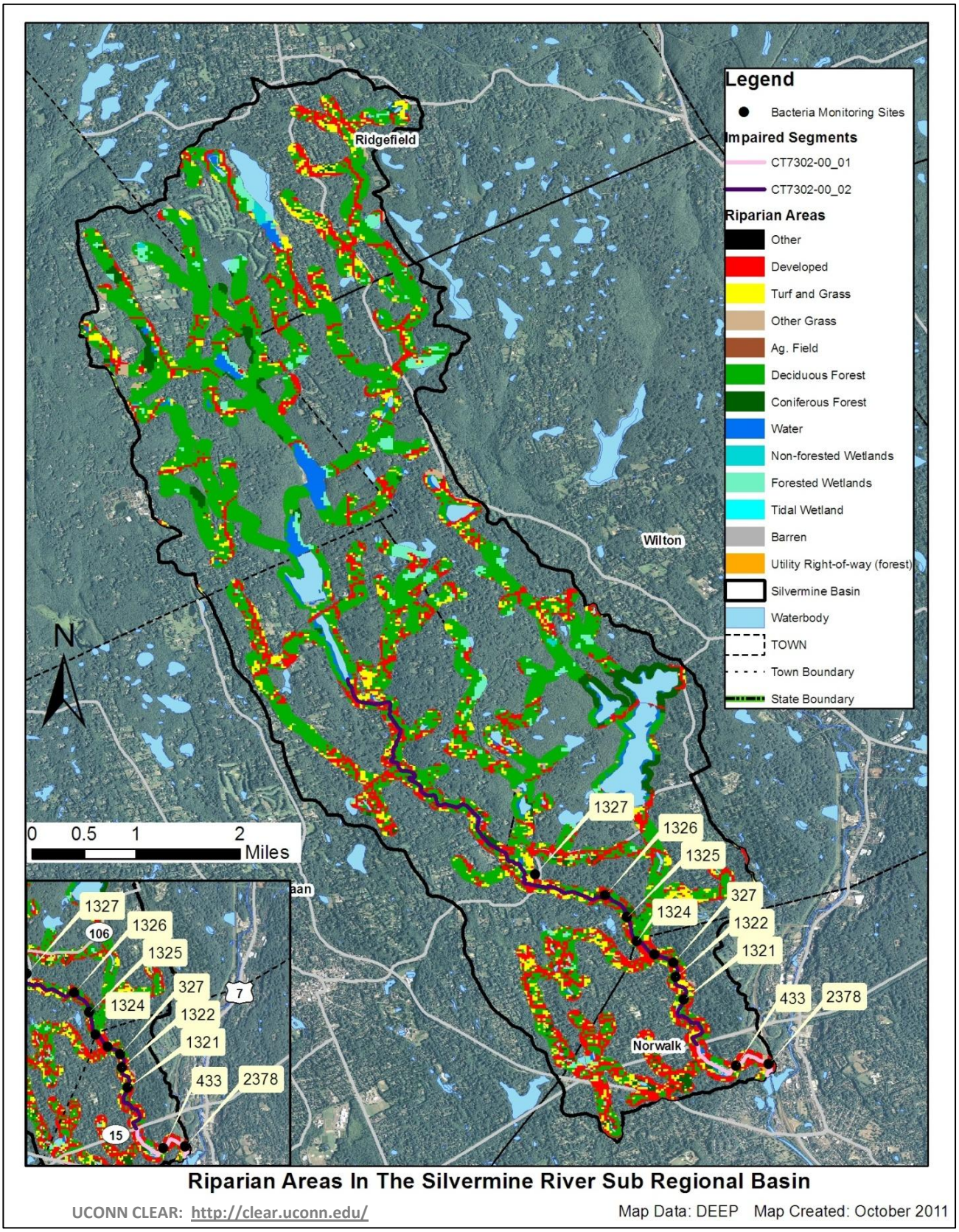
Riparian Buffer Zones

The riparian buffer zone is the area of land located immediately adjacent to streams, lakes, or other surface waters. The boundary of the riparian zone and the adjoining uplands is gradual and not always well-defined. However, riparian zones differ from uplands because of high levels of soil moisture, frequent flooding, and the unique assemblage of plant and animal communities found there. Through the interaction of their soils, hydrology, and vegetation, natural riparian areas influence water quality as contaminants are taken up into plant tissues, adsorbed onto soil particles, or modified by soil organisms. Any change to the natural riparian buffer zone can reduce the effectiveness of the natural buffer and has the potential to contribute to water quality impairment (USEPA, 2011b).

The CLEAR program at UCONN has created streamside buffer layers for the entire State of Connecticut (http://clear.uconn.edu/), which have been used in this TMDL. Analyzing this information can reveal potential sources and implementation opportunities at a localized level. The land use directly adjacent to a waterbody can have direct impacts on water quality from surface runoff sources.

The majority of the riparian zone for the impaired segment of the Silvermine River is characterized by developed and turf grass land use with greater tracts of deciduous forest in the upper half of the impaired segment (Figure 10). As previously noted, if not properly treated, runoff from developed areas may contain pollutants such as bacteria and nutrients.

Figure 10: Riparian buffer zone information for the Silvermine River watershed



CURRENT MANAGEMENT ACTIVITIES

The Towns of New Canaan and Wilton, and the City of Norwalk have developed and implemented programs to protect water quality from bacterial contamination. In 2011, the Norwalk River Watershed Based Plan was completed (NRWIC, 2011). This document outlines current actions in the watershed and recommends future actions necessary to maintain or improve water quality.

CT DEEP's Non-Point Source Pollution Program administers a Non-Point Source Grant Program with funding from EPA under Section 319 of the Clean Water Act (319 grant). The Norwalk River Watershed Initiative received $42,786 for a Goose Management Project to address nonpoint source pollution from the non-migratory Canada goose. Public education campaigns will focus on controlling goose populations and informing the public to not feed the geese. More information about this project is available through CT DEEP (http://www.depdata.ct.gov/maps/nps/npsmap.htm).

CT DEEP also administers a Water Quality Planning Management Grant Program with funding from EPA under Section 604(b) of the Clean Water Act (604(b) grant). In 2011, a 604(b) grant was awarded to the Norwalk River Watershed Initiative Committee to develop a watershed based management plan that addressed nonpoint source pollution in the Silvermine River watershed.

As indicated previously, New Canaan, Wilton and Norwalk are regulated under the MS4 program. The MS4 General Permit is required for any municipality with urbanized areas that initiates, creates, originates or maintains any discharge of stormwater from a storm sewer system to waters of the State. The MS4 permit requires towns to design a Stormwater Management Plan (SMP) to reduce the discharge of pollutants in stormwater to improve water quality. The plan must address the following 6 minimum measures:

1. Public Education and Outreach.
2. Public Involvement/Participation.
3. Illicit discharge detection and elimination.
4. Construction site stormwater runoff control.
5. Post-construction stormwater management in new development and redevelopment.
6. Pollution prevention/good housekeeping for municipal operations.

Each town is also required to submit an annual update outlining the steps they are taking to meet the six minimum measures. All updates that address bacterial contamination in the watershed are summarized in Tables 7 - 9.

Table 7: Summary of MS4 requirement updates related to the reduction of bacterial contamination from New Canaan, CT (GSM000079)

Minimum Measure	New Canaan Annual Report (November 2009)
Public Outreach and Education	1) Requires written confirmation of compliance with soil and erosion control plans, and includes "Erosion Control for Homeowners" fact sheet in Building Department Application Package and reception counter. 2) Public Works Department displays poster on "Stormwater and the Construction Industry". 3) New stormwater brochure and litter bags distributed in 2009. 4) Animal Control Office maintained dispensers and biodegradable bags in parks for dog owners. 5) Town website includes a link for Stormwater Management.
Public Involvement and Participation	1) Currently developing a Stormwater Advisory Committee. 2) The Town and New Canaan Garden Club continue to sponsor river clean-ups. 3) Over 1,000 catch basins stenciled by Town Highway Department.
Illicit Discharge Detection and Elimination	1) Utilized GIS to locate and map 174 stormwater outfalls and 981 catch basins in the business district. 2) Currently developing an Illicit Discharge Town Ordinance. 3) Continuing to identify potential locations of illicit discharge by reviewing available testing data and following up any complaints. 4) Highway Department employees trained on Stormwater Pollution Prevention Plan.
Construction Site Stormwater Runoff Control	No updates.
Post Construction Stormwater Management	1) Enforcement of "zero increase" in runoff from existing developments. 2) Reviewing current drainage requirements for stormwater quality to encourage LID practices.
Pollution Prevention and Good Housekeeping	1) All town roads swept once per year. Streets within the business district are swept twice a week in the spring, summer, and fall. 2) 97% reduction in sand use with the introduction of Ice Ban.

Table 8: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Wilton, CT (GSM000040)

Minimum Measure	Wilton Annual Report (2008)
Public Outreach and Education	1) Publishes biannual newsletters, and maintains website with stormwater management site links. 2) Posted stormwater management and other related information at Town Hall and DPW. 3) Completed stenciling of catch basins that discharge to streams and rivers. 4) CT DOT installed signage marking the stormwater management detention pond across from Allen's Meadow site along Route 7.
Public Involvement and Participation	1) Distributed brochures on household waste collection and recycling programs.
Illicit Discharge Detection and Elimination	1) Trained field staff to look for discharges as part of standard procedure when cleaning catch basins. If found, the source is traced and owner notified. 2) Continues to map storm sewer system.
Construction Site Stormwater Runoff Control	1) Continues to apply land use regulations with new development projects.
Post Construction Stormwater Management	1) Continues to require post-construction stormwater monitoring to evaluate the effectiveness of installed BMPs.
Pollution Prevention and Good Housekeeping	1) Continues to sweep all town roadways and specific parking lots annually. 2) Continues to prioritize and maintain catch basins.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Norwalk, CT (GSM000024)

Minimum Measure	Norwalk Annual Report (2007)
Public Outreach and Education	1) Norwalk River Watershed Initiative and the Maritime Aquarium continue to distribute stormwater brochures. 2) Stormwater management information has been added to the City website. 3) Will provide additional stormwater information through a local access channel.
Public Involvement and Participation	1) Sponsored annual DPW Open House for public participation. 2) Providing public education through grant on installation of catch basin filters. 3) Monthly Water Quality Committee meetings open to the public.

Table 9: Summary of MS4 requirement updates related to the reduction of bacterial contamination from Norwalk, CT (GSM000024) (continued)

Minimum Measure	Norwalk Annual Report (2007)
Illicit Discharge Detection and Elimination	1) The City has mapped all outfalls greater than 12" on the Norwalk and Silvermine Rivers (75% of outfalls). 2) Developing program to detect and eliminate illicit discharges. 3) Developing illicit discharge ordinance.
Construction Site Stormwater Runoff Control	1) Will review its zoning and subdivision regulations pertaining to erosion and sedimentation control and stormwater control measures for all construction activities.
Post Construction Stormwater Management	1) Updated Storm Drainage Manual. 2) Will implement new training program for inspection procedures to ensure conformance to required stormwater management practices.
Pollution Prevention and Good Housekeeping	1) Developed a training program on pollution prevention measures for Public Works and other municipal operations. 2) Continued street sweeping program. 3) Purchased two new vactor trucks. 4) Spent $250,000 to clean catch basins, stormwater pipes and other stormwater structures in the City.

RECOMMENDED NEXT STEPS

The Towns of New Canaan and Wilton and the City of Norwalk have developed and implemented programs to protect water quality from bacterial contamination. Future mitigative activities are necessary to ensure the long-term protection of the Silvermine River and have been prioritized below. Some of these actions are provided in more detail in the 2011 Norwalk River Watershed Based Plan (NRWIC, 2011).

1). Identify areas along the developed portions of the Silvermine River to implement Best Management Practices (BMPs) to control stormwater runoff.

As noted previously, 41% of the Silvermine River watershed is considered urban, and the Towns of New Canaan and Wilton and the City of Norwalk are MS4 communities regulated by the MS4 program. The lower half of the impaired segment of the Silvermine River is located within higher density development with greater than 12% impervious cover. As such, stormwater runoff is likely contributing bacteria to the waterbodies. The Norwalk River Watershed Based Plan (2011) made specific and more long-term general recommendations to reduce the impacts of stormwater runoff on water quality (NRWIC, 2011). The plan highlighted multiple areas along the Silvermine River that need further investigation and possible BMP implementation, especially for waterfowl and small farms (Table 10). At least 8 run-of-river dams were also identified along the Silvermine River, which can act as geese attractants, fish barriers, and nutrient sources.

Table 10: Recommended structural BMPs in Norwalk, New Canaan, and Wilton from the 2011 Norwalk Watershed Based Plan

Location	Town	Recommended BMPs
North of Silvermine Tavern	Wilton	Mitigation of waterfowl and livestock impact at small farm.
Run-of-River dams along Silvermine River	New Canaan, Wilton	Reduce waterfowl impact at dams.
Upper portion of impaired segment	New Canaan	Replace identified failing septic system.
James Street	Norwalk	Investigate dry weather discharge with potential sanitary flows.
Moody's Lane	Norwalk	Investigate dry weather discharge with potential sanitary flows.
Pond outlet at Department of Development Services	Norwalk	Investigate dry weather discharge with potential sanitary flows.
Confluence of Silvermine River and Belden Hill Brook	Wilton	Mitigation of waterfowl and livestock impact at small farm.

To identify other areas contributing bacteria to the impaired segment of the Silvermine River, the municipalities should continue to conduct wet-weather sampling at stormwater outfalls that discharge directly to the impaired segments in the Silvermine River watershed. Outfalls that have previously shown high bacteria concentrations should be prioritized for BMP installation (Table 6). To treat stormwater runoff, the municipalities should identify areas along the impaired segment of the Silvermine River to install BMPs designed to encourage stormwater to infiltrate into the ground before entering the waterbodies. These BMPs would disconnect impervious areas and reduce pollutant loads to the river. More detailed information and BMP recommendations can be found in the core TMDL document.

2). Develop a system to monitor septic systems.

Most residents in the Silvermine River watershed rely on septic systems. A failing septic system has previously been identified along the upper half of the impaired segment of the Silvermine River. If not already in place, New Canaan, Wilton and Norwalk should establish programs to ensure that existing septic systems are properly operated and maintained, and create an inventory of existing septic systems through mandatory inspections. Inspections help encourage proper maintenance and identify failed and sub-standard systems. Policies that govern the eventual replacement of sub-standard systems within a reasonable timeframe can be adopted. New Canaan and Norwalk can also develop a program to assist citizens with the replacement and repair of older and failing systems.

3). Implement a program to evaluate the sanitary sewer system.

Only the extreme lower portion of the Silvermine River watershed in Norwalk downstream of the impaired segment of the Silvermine River relies on the municipal sewer system. Illicit discharge connections to storm sewers were identified as an issue for the Silvermine River in the Norwalk River Watershed Based Plan (2011), and although it is not contributing bacteria to the impaired segment, it may lead to future downstream impairment. Several dry weather discharges with potential sanitary flows along James Street, Moody Lane, and Silvermine Road in Norwalk, CT were also discovered. The Town of New Canaan is already utilizing GIS to locate and map over 174 stormwater outfalls and 981 catch

basins in their business district, and continuing to identify potential illicit discharges. The Town of Wilton is currently mapping their storm sewer systems and training field staff for illicit discharge detection. The Town of Norwalk has mapped all outfalls greater than 12" (approximately 75%) on the Norwalk and Silvermine Rivers, and is developing an illicit discharge elimination and detection program. It is important for these towns to continue and expand these programs to reduce bacterial contamination from leaky sewer systems.

4). Continue monitoring of permitted sources.

Previous discharge sampling from MS4 outfalls has shown elevated levels of bacteria. Further monitoring will provide information essential to better locate, understand, and reduce pollution sources. If any current monitoring is not done with appropriate bacterial indicator based on the receiving water, then a recommended change during the next permit reissuance is to include the appropriate indicator species. If facility monitoring indicates elevated bacteria, then implementation of permit required, and voluntary measures to identify and reduce sources of bacterial contamination at the facility are an additional recommendation. Regular monitoring should be established for all permitted sources to ensure compliance with permit requirements and to determine if current requirements are adequate or if additional measures are necessary for water quality protection.

Section 6(k) of the MS4 General Permit requires a municipality to modify their Stormwater Management Plan to implement the TMDL within four months of TMDL approval by EPA if stormwater within the municipality contributes pollutant(s) in excess of the allocation established by the TMDL. For discharges to impaired waterbodies, the municipality must assess and modify the six minimum measures of its plan, if necessary, to meet TMDL standards. Particular focus should be placed on the following plan components: public education, illicit discharge detection and elimination, stormwater structures cleaning, and the repair, upgrade, or retrofit of storm sewer structures. The goal of these modifications is to establish a program that improves water quality consistent with TMDL requirements. Modifications to the Stormwater Management Plan in response to TMDL development should be submitted to the Stormwater Program of DEEP for review and approval.

Table 11 details the appropriate bacteria criteria for use as waste load allocations established by this TMDL for use as water quality targets by permittees as permits are renewed and updated, within the Silvermine River watershed.

For any municipality subject to an MS4 permit and affected by a TMDL, the permit requires a modification of the SMP to include BMPs that address the included impairment. In the case of bacteria related impairments municipal BMPs could include: implementation or improvement to existing nuisance wildlife programs, septic system monitoring programs, any additional measures that can be added to the required illicit discharge detection and elimination (IDDE) programs, and increased street sweeping above basic permit requirements. Any non-MS4 municipalities can implement these same types of initiatives in effort to reduce bacteria source loading to impaired waterways.

Any facilities that discharge non-MS4 regulated stormwater should update their Pollution Prevention Plan to reflect BMPs that can reduce bacteria loading to the receiving waterway. These BMPs could include nuisance wildlife control programs and any installations that increase surface infiltration to reduce overall stormwater volumes. Facilities that are regulated under the Commercial Activities Stormwater Permit should report any updates to their SMP in their summary documentation submitted to DEEP.

Table 11. Bacteria (e.coli) TMDLs, WLAs, and LAs for Recreational Use

		Instantaneous *E. coli* (#/100mL)						Geometric Mean *E. coli* (#/100mL)	
Class	**Bacteria Source**	**WLA[6]**			**LA[6]**			**WLA[6]**	**LA[6]**
	Recreational Use	**1**	**2**	**3**	**1**	**2**	**3**	**All**	**All**
A	Non-Stormwater NPDES	0	0	0				0	
	CSOs	0	0	0				0	
	SSOs	0	0	0				0	
	Illicit sewer connection	0	0	0				0	
	Leaking sewer lines	0	0	0				0	
	Stormwater (MS4s)	235[7]	410[7]	576[7]				126[7]	
	Stormwater (non-MS4)				235[7]	410[7]	576[7]		126[7]
	Wildlife direct discharge				235[7]	410[7]	576[7]		126[7]
	Human or domestic animal direct discharge[5]				235	410	576		126

(1) **Designated Swimming.** Procedures for monitoring and closure of bathing areas by State and Local Health Authorities are specified in: Guidelines for Monitoring Bathing Waters and Closure Protocol, adopted jointly by the Department of Environmental Protections and the Department of Public Health. May 1989. Revised April 2003 and updated December 2008.

(2) **Non-Designated Swimming.** Includes areas otherwise suitable for swimming but which have not been designated by State or Local authorities as bathing areas, waters which support tubing, water skiing, or other recreational activities where full body contact is likely.

(3) **All Other Recreational Uses.**

(4) Criteria for the protection of recreational uses in Class B waters do not apply when disinfection of sewage treatment plant effluents is not required consistent with Standard 23. (Class B surface waters located north of Interstate Highway I-95 and downstream of a sewage treatment plant providing seasonal disinfection May 1 through October 1, as authorized by the Commissioner.)

(5) Human direct discharge = swimmers

(6) Unless otherwise required by statute or regulation, compliance with this TMDL will be based on ambient concentrations and not end-of-pipe bacteria concentrations

(7) Replace numeric value with “natural levels” if only source is naturally occurring wildlife. Natural is defined as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influences (CT DEEP 2011a). Sections 2.2.2 and 6.2.7 of this Core Document deal with BMPs and delineating type of wildlife inputs.

5). Evaluate municipal education and outreach programs regarding animal waste.

Since the Silvermine River watershed has both urban (41%) and forested (52%) land uses, any education and outreach program should highlight the importance of managing waste from horses, dogs, and other pets and not feeding waterfowl and wildlife. The municipalities and residents can take measures to minimize waterfowl-related impacts such as allowing tall, coarse vegetation to grow in the riparian areas of the Silvermine River that are frequented by waterfowl. Waterfowl, especially grazers like geese, prefer easy access to water. Maintaining an uncut vegetated buffer along the shore will make the habitat less desirable to geese and encourage migration. In addition, any educational program should emphasize that feeding waterfowl, such as ducks, geese, and swans, may contribute to water quality impairments in the Silvermine River and can harm human health and the environment. Animal wastes should be disposed of away from any waterbody or storm drain system. BMPs effective at reducing the impact of animal waste on water quality include installing signage, providing pet waste receptacles in high-use areas, enacting ordinances requiring the clean-up of pet waste, and targeting educational and outreach programs in problem areas. As addressed above, a 319 grant for a Goose Management Project in the Norwalk River watershed, which includes the Silvermine River drainage, has been implemented to improve water quality.

6). Ensure there are sufficient buffers on agricultural lands along the Silvermine River.

Although agricultural land use represents only 1% of the Silvermine River watershed (Figure 4), it is still a concern for water quality, especially with the small hobby farms addressed in the Norwalk River Watershed Based Plan (2011) as potential bacterial sources in the watershed. If not already in place, agricultural producers should work with the CT Department of Agriculture and the U.S. Department of Agriculture Natural Resources Conservation Service to develop conservation plans for their farming activities within the watershed. These plans should focus on ensuring that there are sufficient stream buffers, that fencing exists to restrict livestock and horse access to streams and wetlands, and that animal waste handling, disposal, and other appropriate BMPs are in place.

BACTERIA DATA AND PERCENT REDUCTIONS TO MEET THE TMDL

Table 12: Silvermine River Bacteria Data

Waterbody ID: CT7302-00_02

Characteristics: Freshwater, Class A, Potential Drinking Water Supplies, Habitat for Fish and other Aquatic Life and Wildlife, Recreation, Navigation, and Industrial and Agricultural Water Supply

Impairment: Recreation (*E. coli bacteria)*

Water Quality Criteria for E. coli:

Geometric Mean: 126 colonies/100 mL

Single Sample: 410 colonies/100 mL

Percent Reduction to meet TMDL:

Geometric Mean: **86%**

Single Sample: **96%**

Data: 1998 and 2003 from CT DEEP targeted sampling efforts, 2012 TMDL Cycle

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Silvermine River with annual geometric means calculated

Station Name	Station Location	Date	Results	Wet/ Dry	Geomean
1321	Downstream of Silvermine Elementary School	3/21/2003	66	wet**	294
1321	Downstream of Silvermine Elementary School	4/24/2003	20	dry	
1321	Downstream of Silvermine Elementary School	5/28/2003	860	wet	
1321	Downstream of Silvermine Elementary School	6/6/2003	100	wet	
1321	Downstream of Silvermine Elementary School	6/13/2003	3040	wet	
1321	Downstream of Silvermine Elementary School	6/19/2003	104	wet	
1321	Downstream of Silvermine Elementary School	6/27/2003	200	dry	
1321	Downstream of Silvermine Elementary School	7/11/2003	400	dry	
1321	Downstream of Silvermine Elementary School	7/18/2003	180	dry	
1321	Downstream of Silvermine Elementary School	7/28/2003	240	dry	
1321	Downstream of Silvermine Elementary School	8/4/2003	**11300* (96%)**	wet	
1321	Downstream of Silvermine Elementary School	8/8/2003	550	wet	
1321	Downstream of Silvermine Elementary School	8/15/2003	160	dry	

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Silvermine River with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1322	Upstream of Silvermine Elementary School	3/21/2003	66	wet**	186
1322	Upstream of Silvermine Elementary School	4/24/2003	24	dry	
1322	Upstream of Silvermine Elementary School	5/28/2003	500	wet	
1322	Upstream of Silvermine Elementary School	6/6/2003	80	wet	
1322	Upstream of Silvermine Elementary School	6/13/2003	3860	wet	
1322	Upstream of Silvermine Elementary School	6/19/2003	92	wet	
1322	Upstream of Silvermine Elementary School	6/27/2003	172	dry	
1322	Upstream of Silvermine Elementary School	7/11/2003	240	dry	
1322	Upstream of Silvermine Elementary School	7/18/2003	64	dry	
1322	Upstream of Silvermine Elementary School	7/28/2003	228	dry	
1322	Upstream of Silvermine Elementary School	8/8/2003	510	wet	
1322	Upstream of Silvermine Elementary School	8/15/2003	248	dry	
327	Downstream of Perry Avenue at end of Alvin Road	7/22/1998	405†	dry	277
327	Downstream of Perry Avenue at end of Alvin Road	9/23/1998	190	wet	
1323	Upstream of Perry Avenue crossing	3/21/2003	130	wet**	**886* (86%)**
1323	Upstream of Perry Avenue crossing	4/24/2003	28	dry	
1323	Upstream of Perry Avenue crossing	5/28/2003	1880	wet	
1323	Upstream of Perry Avenue crossing	6/6/2003	260	wet	
1323	Upstream of Perry Avenue crossing	6/13/2003	3400	wet	
1323	Upstream of Perry Avenue crossing	6/19/2003	1600	wet	
1323	Upstream of Perry Avenue crossing	6/27/2003	760	dry	
1323	Upstream of Perry Avenue crossing	7/11/2003	1800	dry	
1323	Upstream of Perry Avenue crossing	7/18/2003	2900	dry	
1323	Upstream of Perry Avenue crossing	7/28/2003	620	dry	
1323	Upstream of Perry Avenue crossing	8/4/2003	10400	wet	
1323	Upstream of Perry Avenue crossing	8/8/2003	730	wet	
1323	Upstream of Perry Avenue crossing	8/15/2003	1140	dry	

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Silvermine River with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1324	Upstream of confluence with Belden Hill Brook	3/14/2003	5	wet**	
1324	Upstream of confluence with Belden Hill Brook	3/28/2003	8	dry**	
1324	Upstream of confluence with Belden Hill Brook	4/25/2003	52	dry	
1324	Upstream of confluence with Belden Hill Brook	5/9/2003	86	wet	
1324	Upstream of confluence with Belden Hill Brook	5/28/2003	230	wet	
1324	Upstream of confluence with Belden Hill Brook	6/6/2003	72	wet	
1324	Upstream of confluence with Belden Hill Brook	6/13/2003	<1	wet	
1324	Upstream of confluence with Belden Hill Brook	6/19/2003	84	wet	71
1324	Upstream of confluence with Belden Hill Brook	6/27/2003	68	dry	
1324	Upstream of confluence with Belden Hill Brook	7/11/2003	136	dry	
1324	Upstream of confluence with Belden Hill Brook	7/18/2003	360	dry	
1324	Upstream of confluence with Belden Hill Brook	7/28/2003	112	dry	
1324	Upstream of confluence with Belden Hill Brook	8/4/2003	3400	wet	
1324	Upstream of confluence with Belden Hill Brook	8/8/2003	160	wet	
1324	Upstream of confluence with Belden Hill Brook	8/15/2003	128	dry	
1325	At NNT confluence	3/14/2003	6	wet**	
1325	At NNT confluence	3/28/2003	3	dry**	
1325	At NNT confluence	4/25/2003	18	dry	
1325	At NNT confluence	5/9/2003	98	wet	
1325	At NNT confluence	5/28/2003	200	wet	
1325	At NNT confluence	6/6/2003	68	wet	
1325	At NNT confluence	6/13/2003	1700	wet	
1325	At NNT confluence	6/19/2003	96	wet	76
1325	At NNT confluence	6/27/2003	48	dry	
1325	At NNT confluence	7/11/2003	48	dry	
1325	At NNT confluence	7/18/2003	40	dry	
1325	At NNT confluence	7/28/2003	44	dry	
1325	At NNT confluence	8/4/2003	3300	wet	
1325	At NNT confluence	8/8/2003	210	wet	

Single sample *E. coli* (colonies/100 mL) data from all monitoring stations on the Silvermine River with annual geometric means calculated (continued)

Station Name	Station Location	Date	Results	Wet/Dry	Geomean
1326	Downstream of Borglum Road crossing	3/14/2003	4	wet**	89
1326	Downstream of Borglum Road crossing	3/28/2003	2	dry**	
1326	Downstream of Borglum Road crossing	4/25/2003	28	dry	
1326	Downstream of Borglum Road crossing	5/9/2003	86	wet	
1326	Downstream of Borglum Road crossing	5/28/2003	130	wet	
1326	Downstream of Borglum Road crossing	6/6/2003	68	wet	
1326	Downstream of Borglum Road crossing	6/13/2003	1660	wet	
1326	Downstream of Borglum Road crossing	6/19/2003	120	wet	
1326	Downstream of Borglum Road crossing	6/27/2003	88	dry	
1326	Downstream of Borglum Road crossing	7/11/2003	40	dry	
1326	Downstream of Borglum Road crossing	7/18/2003	76	dry	
1326	Downstream of Borglum Road crossing	7/28/2003	132	dry	
1326	Downstream of Borglum Road crossing	8/4/2003	4700	wet	
1326	Downstream of Borglum Road crossing	8/8/2003	370	wet	
1327	Downstream of New Canaan Road crossing	3/14/2003	3	wet**	120
1327	Downstream of New Canaan Road crossing	3/28/2003	3	dry**	
1327	Downstream of New Canaan Road crossing	4/25/2003	58	dry	
1327	Downstream of New Canaan Road crossing	5/9/2003	98	wet	
1327	Downstream of New Canaan Road crossing	5/28/2003	180	wet	
1327	Downstream of New Canaan Road crossing	6/6/2003	72	wet	
1327	Downstream of New Canaan Road crossing	6/13/2003	1300	wet	
1327	Downstream of New Canaan Road crossing	6/19/2003	84	wet	
1327	Downstream of New Canaan Road crossing	6/27/2003	184	dry	
1327	Downstream of New Canaan Road crossing	7/11/2003	108	dry	
1327	Downstream of New Canaan Road crossing	7/18/2003	52	dry	
1327	Downstream of New Canaan Road crossing	7/28/2003	84	dry	
1327	Downstream of New Canaan Road crossing	8/4/2003	10900	wet	
1327	Downstream of New Canaan Road crossing	8/8/2003	1800	wet	

Shaded cells indicate an exceedance of water quality criteria

†Average of two duplicate samples

**** Weather conditions for selected data taken from Hartford because local station had missing data**

***Indicates single sample and geometric mean values used to calculate the percent reduction**

Wet and dry weather *E. coli* (colonies/100 mL) geometric mean values for all monitoring stations on the Silvermine River

Station Name	Station Location	Years Sampled	Number of Samples		Geometric Mean		
			Wet	Dry	All	Wet	Dry
1321	Downstream of Silvermine Elementary School	2003	7	6	294	526	149
1322	Upstream of Silvermine Elementary School	2003	6	6	186	280	124
327	Downstream of Perry Avenue at end of Alvin Road	1998	1	1	277	NA	NA
1323	Upstream of Perry Avenue crossing	2003	7	6	886	1148	654
1324	Upstream of small farm at confluence with Belden Hill Brook	2003	8	7	61	49	79
1325	At NNT confluence	2003	8	6	76	176	25
1326	Downstream of Borglum Road crossing	2003	8	6	89	179	35
1327	Downstream of New Canaan Road crossing	2003	8	6	120	231	50

Shaded cells indicate an exceedance of water quality criteria

Weather condition determined from rain gages at Stamford 5 N station in Stamford, CT and at Hartford Bradley International Airport

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